

HRS DOCUMENTATION RECORD REVIEW COVER SHEET

Name of Site: Aberdeen Contaminated Ground Water
NCN 000 407 447

Contact Persons:

U.S. Environmental Protection Agency, Region 4:

(Name)	(Telephone)
Jennifer Wendel, NC Site Management	(404) 562-8799

North Carolina Department of Environment and Natural Resources:

Site Investigation:	(Name)	(Telephone)
	Harry Zinn	(919) 508-8488

Documentation Record:	Harry Zinn	(919) 508-8488
-----------------------	------------	----------------

Pathways, Components, or Threats Not Evaluated:

Surface Water Pathway

None of the surface water pathway's threats would add significantly to the overall HRS site score.

Drinking Water threat/targets:

The drinking water threat was not scored because there is no drinking water intake within the 15-mile surface water pathway downstream of the site.

Human Food Chain and Environmental threats/targets:

The HFC and environmental threats were not scored due to the distance (over $\frac{3}{4}$ of a mile) to either of two possible points of entry, and due to low ecological risk and bio-accumulation factors for trichloroethene (TCE).

Soil Exposure Pathway

The site is a ground water plume with no identified source. No eligible area of observed contamination has been identified.

Air Pathway

The site is a ground water plume with no identified source. The Air Pathway was not scored because no release of site contaminants to the air is suspected.

HRS DOCUMENTATION RECORD

Name of Site: Aberdeen Contaminated Ground Water

EPA Region: 4 Date Prepared: March 2008

Street Address of Site*: Highway 211, Old Pee Dee Road, Blues Bridge Road and Crestline Lane

County and State: Aberdeen, Moore County, NC 28315

General Location in the State: Coastal Plains

Topographic Map: Pinebluff, NC

Latitude: 35.1224°N Longitude: 79.4025°W

The site reference point for the Aberdeen Contaminated Ground Water site is MW-5B (also known as EPA-1D), the most highly contaminated well, located on the Powder Metal Products facility (Refs. 5, p. 4; 12, pp. 3, 8; see also Figure 1 in this HRS documentation record).

* The street addresses, coordinates, and contaminant locations presented in this HRS documentation record identify the general area in which the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known “releases or threatened releases” of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been “deposited, stored, placed, or otherwise come to be located.” Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

Ground Water Pathway	100.00
Surface Water Pathway	Not Scored
Soil Exposure Pathway	Not Scored
Air Pathway	Not Scored
HRS SITE SCORE	<u>50.00</u>

WORKSHEET FOR SITE SCORE

	S	S ²
1. Ground Water Migration Pathway Score	<u>100.00</u>	<u>10,000</u>
2a. Surface Water Overland/Flood Migration --		
Drinking Water Threat	Not Scored	
Food Chain Threat	Not Scored	
Environmental Threat	Not Scored	
Surface Water Overland/Flood Migration Component (subject to maximum value of 100, Ref. 1, section 4.1.5) _____		
3. Soil Exposure Pathway Score	Not Scored	
4. Air Migration Pathway Score	Not Scored	
5. Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2 =$		<u>10,000</u>
6. HRS Site Score: Value on line 5. divided by four, then take the square root		<u>50.00</u>

Site Name: Aberdeen Contaminated Ground Water Region: 4

City, County, State: Aberdeen, Moore NC Evaluator: Harry Zinn

EPA ID#: NCN 000 407 447 Date:

Lat/Long: 35.1224/79.4025 T/R/S:

Congressional District: 6

This Scoresheet is for: HRS Package

Scenario Name: Contaminated Ground Water

Description: Contaminated Plume with unknown source

	S pathway	S ² pathway
Ground Water Migration Pathway Score (S _{gw})	100	10000
Surface Water Migration Pathway Score (S _{sw})		
Soil Exposure Pathway Score (S _s)		
Air Migration Score (S _a)		
$S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		10000
$(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2)/4$		2500
$\sqrt{(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2)/4}$		50.00

TABLE 3-1 --GROUND WATER MIGRATION PATHWAY SCORESHEET			
Factor categories and factors		Maximum Value	Value Assigned
Aquifer Evaluated: All			
Likelihood of Release to an Aquifer:			
1. Observed Release	550	550	
2. Potential to Release:			
2a. Containment	10		
2b. Net Precipitation	10		
2c. Depth to Aquifer	5		
2d. Travel Time	35		
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500		
3. Likelihood of Release (higher of lines 1 and 2e)	550		550
Waste Characteristics:			
4. Toxicity/Mobility	(a)	10000	
5. Hazardous Waste Quantity	(a)	100	
6. Waste Characteristics	100		32
Targets:			
7. Nearest Well	50	50	
8. Population:			
8a. Level I Concentrations	(b)	5480	
8b. Level II Concentrations	(b)	0	
8c. Potential Contamination	(b)	0	
8d. Population (lines 8a + 8b + 8c)	(b)	5480	
9. Resources	5	0	
10. Wellhead Protection Area	20	0	
11. Targets (lines 7 + 8d + 9 + 10)	(b)		5530
Ground Water Migration Score for an Aquifer:			
12. Aquifer Score [(lines 3 x 6 x 11)/82,5000] ^c	100		100
Ground Water Migration Pathway Score:			
13. Pathway Score (S _{gw}), (highest value from line 12 for all aquifers evaluated) ^c	100		100

^a Maximum value applies to waste characteristics category

^b Maximum value not applicable

^c Do not round to nearest integer

ABERDEEN CONTAMINATED GROUND WATER
ABERDEEN, MOORE COUNTY, NC
LIST OF REFERENCES

1. US Environmental Protection Agency; Hazard Ranking System, Final Rule, 55 FR 51532, 1990 and Comprehensive Environmental Response, Compensation, and Liability Act (42 U. S. C. 9601). 2 pages. Excerpt.
2. US Environmental Protection Agency; Superfund Chemical Data Matrix (SCDM). Report dated January 2004; Revised TCE page dated June 23, 2006 and October 30, 2006. 8 pages. Excerpt.
3. Zinn, Harry, NC Superfund Section, Memo to File, Regarding MW-5B and EPA-1D. February 8, 2008. 1 page.
4. Art Barnhardt, Division of Water Quality/Groundwater Section; Memorandum RE: Former Powder Metals Plant, March 26, 2001. 2 pages.
5. Zinn, Harry, NC Superfund Section; Preliminary Assessment/Site Inspection, Aberdeen Contaminated Groundwater, September 30, 2004. 19 pages.
6. US EPA Region IV; Record of Decision, Summary of Remedial Alternative Selection, Geigy Chemical Corporation Site. August 27, 1992. 153 pages.
7. Rust Environment and Infrastructure; Downgradient Groundwater Investigation Data Summary Report, Geigy Chemical Corporation Site. March 1996. 475 pages.
8. Klutz, William, On-Scene Coordinator, US EPA. Request for Removal Action Approval at the Route 211 Contaminated Well Site in Aberdeen, North Carolina. Dated May 15, 1990. Request for Ceiling Increase at the Route 211 Contaminated Well Site in Aberdeen, North Carolina. Dated August 22, 1991. 13 pages.
9. Snavelly, Keith, NC DEHNR Superfund Section; Site Inspection, Crestline Contaminated Wells NCD 986 172 492 dated November 22, 1995. 37 pages.
10. NC DENR Division of Water Quality; Well Construction Records and Analytical Results of DWQ Wells, April and May, 2000. 32 pages.
11. Geophex, Ltd.; Comprehensive Site Assessment of the Former Asphaltic Materials Laboratory, Lee Paving Company Site, Aberdeen, Moore County, North Carolina, Priority Site Number 21, Revised Final Report. January, 1997. 348 pages.

ABERDEEN CONTAMINATED GROUND WATER
ABERDEEN, MOORE COUNTY, NC
LIST OF REFERENCES

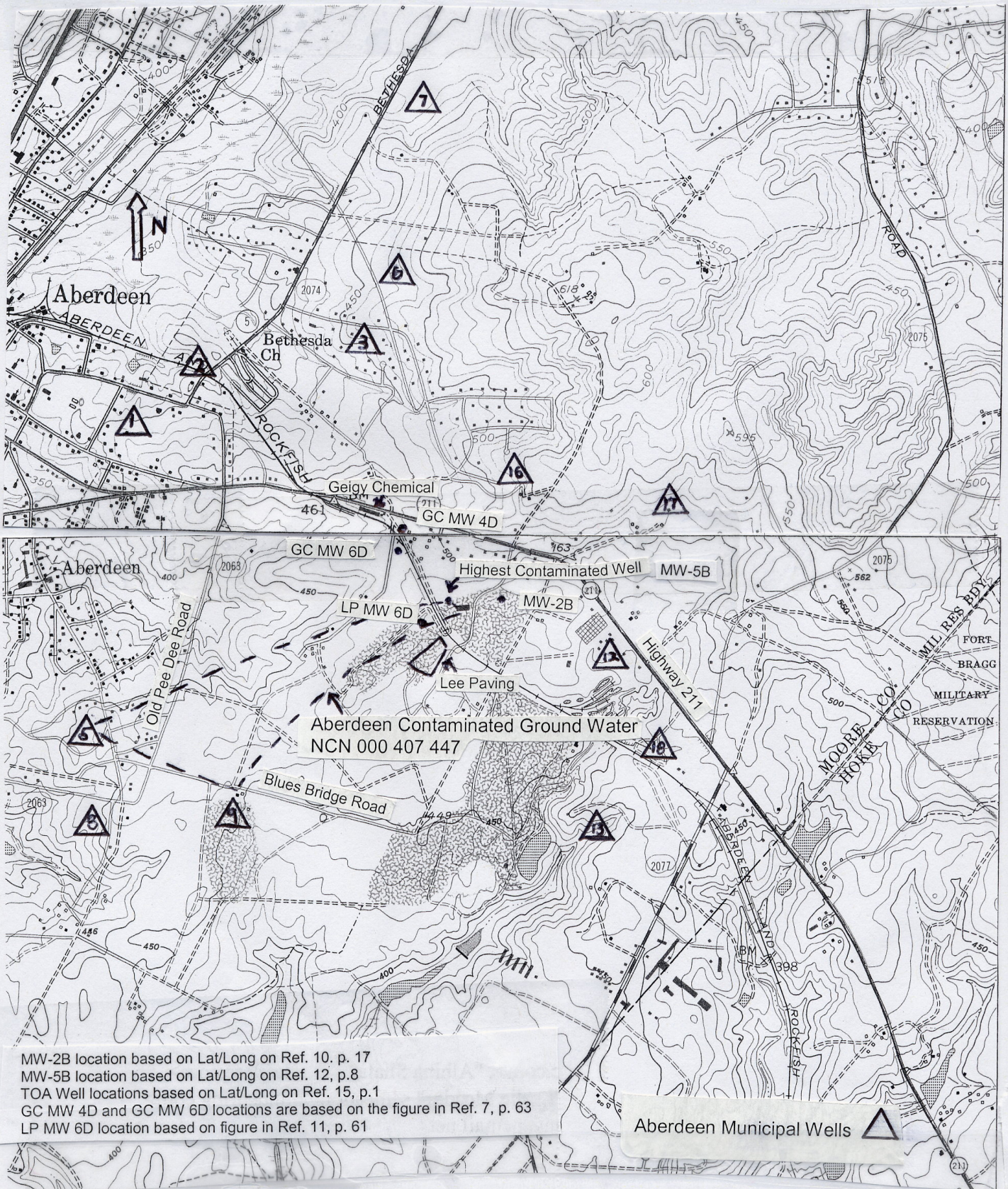
12. Striggow, Brian, US EPA, to Jennifer Wendel, NSMB Waste Management Division; Memorandum RE; Well Installation at Aberdeen Groundwater Contamination Site. November 2003. 12 pages.
13. Miller, Herbert US EPA, to Harry Zinn, NC, Janice Thomas, US EPA, and Jennifer Wendel, US EPA; e-mail RE: Photos at Diamond Exhaust July 9, 2007. 1 page.
14. Zinn, Harry, NC Superfund Section, Analytical Results of sampling event on 4/20, 21/2004. 27 pages.
15. NC DENR Public Water Supply Information dated 9/13/2007. 2 pages.
16. Zinn, Harry, NC Superfund Section, Field Logs of sampling event on 4/20, 21/2004. 33 pages.
17. Aberdeen Municipal Well TCE Contamination Levels from <https://www.pwss.enr.state.nc.us/NCDWW> and Town of Aberdeen fax to Harry Zinn on Well construction of Wells 16, 17, 18, and 19 January 23, 2008. 27 pages.
18. US Environmental Protection Agency, "Using Qualified Data to Document an Observed Release and Observed Contamination", EPA 540-F-94-028, OSWER 9285.7-14FS, PB94-963311, November 1996. 18 pages.
19. Stanley, Jeanette, Chemist, NC Superfund Section, Memo to file, January 29, 2008 and Environment 1, Inc., Laboratory Data and Custody forms from Wells #5, 9, and 18 sampled 07/10/07. 10 pages.
20. Stanley, Jeanette, Chemist, NC Superfund Section, Memo to file, January 29, 2008 and 15A NCAC Subchapter 18D – Water Treatment Facility Operators Rules. 5 pages.
21. Stanley, Jeanette, Chemist, NC Superfund Section, Memo to file, January 29, 2008, SUBJECT: Certification of Environment 1, a Certified Drinking Water Commercial Laboratory. 16 pages.
22. Stanley, Jeanette, Chemist, NC Superfund Section, Memo to file, January 29, 2008 and Neal, John L., Chemistry Manager, Environmental Sciences Unit, North Carolina State Laboratory of Public Health, Memo to Jeanette Stanley, NC Superfund Program, NC Division of Waste Management, January 29, 2008. Re: Estimated Data. 3 pages.

ABERDEEN CONTAMINATED GROUND WATER
ABERDEEN, MOORE COUNTY, NC
LIST OF REFERENCES

23. Zinn, Harry, Environmental Engineer, Memo to file, February 11, 2008, Subject: Town of Aberdeen Well Data. 1 page.
24. USGS, US Department of the Interior, "Hydrogeology and Simulation of Ground-Water Flow in Aquifers at the Aberdeen Superfund Sites, North Carolina." 1993. 99 pages. Excerpt.

ABERDEEN CONTAMINATED GROUND WATER
ABERDEEN, MOORE COUNTY, NC
LIST OF FIGURES

1. Topographic Map of the Area Around the Aberdeen Contaminated Ground Water Site. Based on US Geological Survey, 7.5-minute topographic quadrangle maps of North Carolina; Pinebluff, NC, 2002; Southern Pines, NC, 1984.
2. Street Map of the Area Around the Aberdeen Contaminated Ground Water Site. Based on Google map.



MW-2B location based on Lat/Long on Ref. 10, p. 17
 MW-5B location based on Lat/Long on Ref. 12, p. 8
 TOA Well locations based on Lat/Long on Ref. 15, p. 1
 GC MW 4D and GC MW 6D locations are based on the figure in Ref. 7, p. 63
 LP MW 6D location based on figure in Ref. 11, p. 61

Aberdeen Municipal Wells



Site: Aberdeen Contaminated Ground Water

US EPA ID #: NCN 000 407 447

Aberdeen, Moore County

Approximate Scale: 1:24,000

Figure 1

Date: 02/08/08

Drawn By: HJZ



MW-1B and MW-2B locations based on Lat/Long on Ref 10, p. 17
 MW-5B location based on Lat/Long on Ref. 12, p.8
 TOA #5 and TOA #9 locations based on Lat/Long on Ref. 15, p.1



Site: Aberdeen Contaminated Ground Water

US EPA ID #: NCN 000 407 447

Aberdeen, Moore County

Approximate Scale: As Shown

Figure 2

Date: 02/08/08

Drawn By: HJZ

1.0 Location

The Aberdeen Contaminated Ground Water site (ACG) (NCN 000 407 447) is located along Highway 211 approximately 1 ½ miles east of Highway 1 in Aberdeen, Moore County, NC (Figure 1). The contaminated ground water plume is roughly bordered by Highway 211 to the north, Old Pee Dee Road to the west, Blues Bridge Road to the south and Blues Bridge Road and Crestline Lane to the east. The geographic coordinates for the site are 35.1224° north latitude and 79.4025° west longitude (Ref. 12). The site reference point is the most highly contaminated well located on the former Powder Metal Products property (Ref. 12).

The site area is a mix of industrial, commercial and residential uses. Several of the industrialized areas have been investigated for environmental problems (Ref. 5, p. 1).

Definitive attribution of the TCE plume at this site to a specific source will not be possible without a ground water investigation of a scale and scope similar to that employed during a Remedial Investigation. An array of single, double and triple cased wells will be required to confirm a source area at the former Powder Metal Products facility, a suspected source based on currently available ground water data.

Recent data (2007) shows that two municipal wells serving the Town of Aberdeen have been contaminated with TCE. The capacity of these wells is vital to the overall capacity of the Town of Aberdeen system (Ref. 23, p. 1). One well has a TCE concentration higher than the Maximum Contaminant Level (MCL) allowed in drinking water. The other well has a TCE concentration below the MCL but above the Cancer Risk Screening Concentration. Aberdeen's water supply is a system of 17 wells serving a total of 4655 people, and the loss of service from the two impacted wells strains the system to its limit in serving that population. The Town of Aberdeen system is a blended system with no one well supplying 40% or more of the total capacity (Ref. 23, p. 1). Several other municipal wells are nearby and are threatened by this site.

In order to protect the water supply of the Town of Aberdeen in a timely matter, this site is being scored as a ground water plume with no identified source.

1.1 Site History

The site is a ground water plume with no identified source. The plume was identified during investigations of other sites and facilities in the area. These include: the Geigy Chemical Corporation (Aberdeen Plant) site, the Crestline Contaminated Well site (formerly known as the Route 211 Contaminated Well site), the former Lee Paving Company property, and the former Powder Metal Products facility.

Geigy Chemical Corporation (Aberdeen Plant) site (NCD 981 927 502) (Geigy) was listed on the NPL on October 4, 1989 (Ref. 6, p. 15). Geigy has been operated by several companies since approximately 1947. From approximately 1947 until 1967 it was used for pesticide formulation and retail sales. From 1968 until 1989 it was a retail distributor of agricultural chemicals, mainly fertilizers. Geigy was unoccupied in 1992 (Ref. 6, p. 14). Soil and ground water contamination with pesticides are the primary concerns of the Geigy site (Ref. 6, pp. 18-26).

In 1990 during the investigation of ground water contamination at the Geigy site, located along Highway 221 and Lockey Drive, TCE was detected in the two deep wells MW-4D (200ug/l) and MW-6D (11ug/l) screened in the Upper Black Creek Formation. During the second phase of ground water investigation, TCE was detected in the same two deep wells, a residential well at 10236 Highway 211 East (72 ug/l), and a well at the Powder Metal Products (PMP) facility (360 ug/l) (Ref. 6, pp. 85, 89). This contamination has been determined by EPA to not be related to the Geigy site (Ref. 7, p.36). The majority of the Geigy facility is located north of MW-4D and MW-6D which delineate the northern boundary of the Aberdeen Contaminated Ground Water plume (Ref. 6, p. 21). Geigy Chemical's wells MW-4D and MW-6D are referred to as the GC MW 4D and GC MW 6D on Figure 1.

In May 1990 a Request for Removal Action at the "Route 211 Contaminated Well Site" in Aberdeen, North Carolina was submitted to connect up to 10 private residences or businesses to the municipal water system of Aberdeen, due to lead and TCE contamination. This Request for Removal Action was expanded in 1991 to up to 40 residences or businesses (Ref. 8, pp. 1-13). This site later became the Crestline Contaminated Well site. A follow up Site Inspection for Crestline Contaminated Wells (NCD 986 172 492) in November 1995 indicated continued TCE contamination of three industrial wells and two residential wells, all of which had been disconnected in the Removal Action (Ref. 9, pp. 4, 20). Since the threat to human health had been removed and no threat to the environment was established, the site was recommended for No Further Remedial Action Planned (Ref. 9, p. 25). While the exact location of the wells removed from service during the Removal Actions cannot be determined, some of these wells may be in the Aberdeen Contaminated Ground Water plume once it is fully delineated during the Remedial Investigation.

Another nearby area of environmental concern was the former Lee Paving Company property located at Lockey Drive and Lee Paving Road, northeast of the center of the Aberdeen Contaminated Ground Water plume (Ref. 11, pp. 59, 60, 61). From 1964 until 1989, the NC DOT operated a testing laboratory on the Lee Paving Company property (Ref. 11, p. ii). Since 1989, the site has been used for the storage and handling of recyclable wastes (Ref. 9, p. 5). In 1992 the North Carolina Department of Transportation (DOT) and the North Carolina Department of Environment, Health, and Natural Resources (DEHNR) began assessments of asphaltic materials testing sites in the state. From 1994 to 1996, Geophex, under contract to the DOT, conducted a comprehensive site assessment (CSA) and an additional study of the geology and hydrogeology of the site area. These studies were concentrated on the contaminants: TCE, 1,1,1-trichloroethane (TCA), carbon tetrachloride (CTC) and their degradation products (Ref. 11, p.1). Samples collected in 1994 and 1995 have documented a co-mingled plume of TCE and TCA originating in the southern portion of the Lee Paving site and migrating west in the surficial aquifer as depicted in Figure 23 and 24 of the Comprehensive Site Assessment of the Former Asphaltic Materials Laboratory, Lee Paving Site (Ref. 11, pp. 59, 60). MW-6D located on the northern extent of the Lee Paving site and screened in the Black Creek aquifer has been impacted by TCE only. (Lee Paving well MW-6D is referred to as LP MW 6D on Figure 1). No other monitoring wells on the Lee Paving Property and screened in the Black Creek aquifer (MW 1D, 7D, 8D and 9D) have been contaminated (Ref. 11, pp. 30, 32). Two surficial aquifer monitoring wells (TMW-6 and GP-5), north of the documented plume and south of MW-6D, were not contaminated (Ref. 11, pp. 33, 34). Therefore, it was concluded that the contaminant found in MW-6D is isolated from the documented plume on the Lee Paving site (Ref. 11, pp. 23, 61). It is believed that this contaminant is migrating from an off-site source (Ref. 11, p. 14).

Powder Metal Products (PMP) owned and operated a plant used to manufacture precision machine parts from approximately 1980 until 1995. A part of this process was a dip bath using TCE (Refs. 4, p. 1; 5, p. 4; 13). PMP was a company based in St. Mary's Pennsylvania. In 1998-99 PMP filed for Chapter 11 bankruptcy. The assets, not including the Aberdeen property, were purchased by Metal Powder Products of Indiana. In 1995 the Aberdeen property was sold and began to be operated as Diamond Exhaust & Equipment, a wholesale automotive exhaust parts distribution center at the PMP property (Ref. 5, p. 4).

In 2000, North Carolina Division of Water Quality (DWQ) installed four nested pairs of wells around the PMP facility. The shallow wells (A) were screened in the surficial aquifer (43 – 73 feet bls) and the deeper wells (B) were screened in the Black Creek Formation (104 – 128 feet bls). These wells are located northeast (MW-4), west (MW-1) south (MW-3) and southeast (MW-2) of the PMP facility. Samples from these wells have documented TCE contamination in the western and southern areas around the PMP property. The contaminant levels also indicated a higher concentration in the Black Creek Formation than the surficial aquifer with the highest concentration due west of the facility (Ref. 10, pp. 1, 31).

In order to better document a source area for the TCE contamination thought to be possibly emanating from the PMP property, the US EPA Region IV Science and Ecosystem Support Division (SESD) installed a nested pair of wells at the PMP facility (Refs. 5, executive summary; 12, p. 3). The shallow well (MW-5A) had its screen installed immediately above the first confining layer at 70 foot depth and the deep well (MW-5B) had its screen installed immediately above the second confining layer at 114 foot depth (Refs. 5, executive summary; 12, pp. 5-6, 8). The depths conform to those listed in previous reports as the bottom of the surficial aquifer and the bottom of the Black Creek Formation (Ref. 5, executive summary). TCE and 1,1-DCE, which is one of TCE's degradation products, were detected at their highest levels in MW-5B (Ref. 5, p. 8; 14, pp. 5, 9, 12, 13, 21, 23).

This HRS documentation record does not name the PMP facility as the source of the Aberdeen Contaminated Ground Water plume, because definitive attribution of the TCE plume at this site to a specific source will not be possible without a ground water investigation of a scale and scope similar to that employed during a Remedial Investigation.

While the possibility of a spill from a railroad tanker has been mentioned, no documentation has been found to support this and no persons have been found to confirm this either (Ref. 4, p. 2).

These results indicate a migration of contamination from the surficial aquifer to the Black Creek Aquifer. Most of the water supply wells in this area of Aberdeen are screened in the Upper Black Creek aquifer and the surficial aquifer (Ref. 9, p. 12).

SOURCE DESCRIPTION

2.2 Source Characterization

Number of the Source: 1

Name and description of the source: Contaminated Ground Water Plume with no identified source.

Source Type: Other

Location of the source, with reference to a map of the site:

The contaminated ground water plume extends west from the PMP facility to Town of Aberdeen Well #5. (Figure 1)

Containment

Release to ground water – Monitoring Well 5B has been impacted by TCE, 1,1-Dichloroethene (1,1-DCE) and cis-1,2-Dichloroethene (cis-1,2-DCE) (Ref. 14, pp. 13, 18, 23, 25).

Containment factor:

This information, applied to Table 3-2 in Reference 1 yields a containment value of **10**.

2.3 Likelihood of Release

The likelihood of release for the ground water migration pathway is discussed in Section 3.1.1 of this documentation record. Contamination has been documented in the Surficial and the Upper Black Creek aquifers. Ground water samples collected from the above mentioned well have the highest level of TCE found in any of the wells sampled within a one mile radius of the center of the plume.

2.4 Waste Characteristics

2.4.1 Hazardous Substances

- Background Concentrations

Well ID	Sampling Date	Sampling Time	Screened Interval	Refs.
TOA #18	07/10/07	0845	160-182, 188-205 feet bgs	Ref. 17, pp. 6, 7, 24; Ref. 19, pp. 8-10; Ref. 20, p.1; Ref. 23, p. 1
MW2B	04/20/04	1400	106-116 feet bgs	Ref. 10, pp. 7; Ref. 14, pp. 1, 3, 21; Ref. 16, p. 5

bgs = below ground surface

Hazardous Substances in background samples:

Well ID	TCE	1,1-DCE	cis-1,2-DCE	References
MDL/RRL	0.5 ug/l	0.5 ug/l	0.5 ug/l	Refs. 14, p. 21; 19, pp. 9-10
TOA #18	ND	ND	ND	Ref. 17, pp. 6, 7, 24; Ref. 19, pp. 8-10; Ref. 20, p. 1; Ref. 21
MW2B	ND	ND	ND	Ref. 14, p. 1, 3, 21; Ref. 22, pp. 1 - 3

ug/l = micrograms per liter

MDL = method detection limit

RRL = required reporting limit

ND = Analyzed for but not detected

BOLD = Greater than or equal to 3 x background or greater than detection limit if background is non-detect

Contaminated Samples - Ground water

Monitoring Well 5B (EPA-1D) installed by the US EPA SEDS in October 2003, has been impacted by trichloroethene and the daughter products 1-1, dichloroethene and cis-1-2, dichloroethene (Ref. 5, executive summary; Ref. 12, pp. 3, 6, 12; Ref. 14, pp. 1, 13, 23). Monitoring Well 1B installed by NC DWQ in May 2000 has been impacted by these same contaminants (Refs. 10, p. 3; 14, pp. 1, 9, 23). Both wells are screened in the Upper Black Creek aquifer (fig. 2). Town of Aberdeen Wells #5 and #9 have been impacted by TCE above the Cancer Risk Screening Concentration (0.21 ug/l) (Refs. 2, p. 2; 17, pp. 1, 2, 3).

Ground water release samples

Well ID	Sampling Date	Sampling Time	Screened Interval	Refs.
MW5B (EPA-1D)	04/21/04	1820	104-114 feet bgs	Ref. 5, executive summary; Ref. 12, p. 8; Ref. 16, p. 27
MW1B	04/21/04	1415	104-114 feet bgs	Ref. 10, p. 3; Ref. 16, p. 19
TOA #5	07/10/07	0830	70-76, 84-106, 138-159 feet bgs	Ref. 17, pp. 2, 3, 14; Ref. 19, pp. 2-4; Ref. 20, p. 1
TOA #9	07/10/07	0930	100-125, 150-175 feet bgs	Ref. 17, pp. 4, 5, 14; Ref. 19, pp. 5-7; Ref. 20, p. 1

bgs = below ground surface

Contaminated Samples - Ground Water

Hazardous substances found in ground water release samples

Well ID	TCE	1,1-DCE	cis-1,2-DCE	References
MDL/RRL	0.5 ug/l	0.5 ug/l	0.5 ug/l	Ref. 14, p. 23; Ref. 19, pp. 3-4, 9-10
MW5B	1488.9 J (896.9)	15.8	3.6	Ref. 14, pp. 23; Ref. 22, pp. 1 - 3
MW1B	1181.1 J (711.5)	12.1	8.9	Ref. 14, pp. 23; Ref. 22, pp. 1 - 3
TOA #5	6.6	ND	ND	Ref. 17, pp. 2, 3; Ref. 19, pp. 2-4; Ref. 20, p. 1; Ref. 21, pp. 1 - 16
TOA #9	2.4	ND	ND	Ref. 17, p. 4, 5; Ref. 19, pp. 5-7; Ref. 20, p. 1; Ref. 21, pp. 1 - 16

ug/l = micrograms per liter

MDL = method detection limit

RRL = required reporting limit

ND = Analyzed for but not detected

BOLD = Greater than or equal to 3 x background or greater than detection limit if background is non-detect

J = Estimated Value (Ref. 14, p. 23), Bias uncertain (Ref. 22, p. 1), Value in parenthesis is result divided by Correction Factor of 1.66 to account for uncertain bias (Ref. 18, pp. 6, 7, 12).

Discussion:

Ground water samples collected from MW5B have the highest levels of TCE found in any of the wells sampled within a one mile radius of the center of the plume.

Samples TOA #5 and TOA #9 were collected by a trained water sample collector (Ref. 20) and analyzed by an NC-Certified Drinking Water Commercial Laboratory (Ref. 21) Samples MW5B and MW1B were collected by NC Superfund personnel and analyzed by State Laboratory of Public Health (Refs. 5, p. 4; 22).

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

Sufficient evidence does not exist to evaluate Hazardous Constituent Quantity as required by Reference 1, Section 2.4.2.1.1.

2.4.2.1.2 Hazardous Wastestream Quantity

Sufficient evidence does not exist to evaluate Hazardous Wastestream Quantity as required by Reference 1, Section 2.4.2.1.2.

2.4.2.1.3 Volume

Sufficient evidence does not exist to evaluate Volume as required by Reference 1, Section 2.4.2.1.3. Therefore, the volume is assigned a value of “greater than zero, but unknown.”

2.4.2.1.4 Area

The area HWQ factor is not evaluated for source type “other” (Ref. 1, Table 2-5).

2.4.2.1.5 Source Hazardous Waste Quantity Value = greater than zero, but unknown

For a migration pathway, if the hazardous constituent quantity is not adequately determined for one or more sources, assign a factor value as follows: If any target for that migration pathway is subject to Level I or Level II concentrations, assign either the value from Table 2-6 or a value or **100**, whichever is greater, as the hazardous waste quantity factor value for that pathway (Ref. 1, section 2.4.2.2). Town of Aberdeen Well #5 has been impacted above the Maximum Contaminant Level (MCL) of 5 ug/l (Ref. 2, p.2) and continues in use (Ref. 15), therefore, the population being served by this well is considered subject to Level I exposure (Ref. 1, Secs. 2.5.1, 2.5.2). Town of Aberdeen Well #9 has been impacted by TCE; the levels detected have not exceeded the MCL, however, the levels do exceed the Cancer Risk Screening Concentration of 0.21 ug/l (Ref. 2, p. 2) and continues in use (Ref. 15), therefore, the population being served by this well are considered subject to Level I exposure (Refs. 1, Secs. 2.5.1, 2.5.2; 17, pp. 2, 3, 4, 5).

SITE SUMMARY OF SOURCE DESCRIPTIONS

Containment

Source Hazardous					
Source Waste Quantity <u>No.</u>	<u>Value</u>	Ground <u>Water</u>	Surface <u>Water</u>	<u>Gas</u>	Air <u>Particulate</u>
1	> 0	10	NS	NS	NS

Sum of Source Hazardous Waste Quantity Values = > 0

Based on HRS (Ref. 1, Sec. 2.4.2.2), the Hazardous Waste Quantity Factor Value = **100**.

For a migration pathway, if the hazardous constituent quantity is not adequately determined for one or more sources, assign a factor value as follows: If any target for that migration pathway is subject to Level I or Level II concentrations, assign either the value from Table 2-6 or a value or **100**, whichever is greater, as the hazardous waste quantity factor value for that pathway (Ref. 1, section 2.4.2.2)

NOTE: NS = not scored

Hazardous Waste Quantity Factor Value = **100**

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 Regional Geologic Units

The geologic makeup of the site region consists of layered coastal plain sedimentary formations overlying basement bedrock. The most geologically recent, surface unit is the Tertiary Pinehurst formation, which consists of unconsolidated quartz sand. In Aberdeen, the Pinehurst formation is underlain by the late Cretaceous Middendorf Formation, which consists of sand interbedded with clay or sandy-clay lenses. Beneath the Middendorf formation lies the late Cretaceous Cape Fear Formation, consisting of clay with some interbedded sand units. Beneath this lie Carolina Slate Belt and Triassic basement rocks, which locally include an upper layer of residual saprolite and partially weathered rock (Ref. 24, pp.10-12).

In the Aberdeen area, erosion by surface drainage has dissected the Pinehurst formation, which now exists only in upland areas. The Middendorf is exposed at the land surface in lower areas, while the upper Cape Fear Formation is locally exposed at stream channels and other lowlands (Ref. 24, pp.14-15).

3.0.2 Local Hydrogeologic Units

The USGS has conducted a study on the hydrogeology of the Aberdeen area. The study defines a hydrogeologic framework consisting five distinct hydrogeologic units. These include an unconfined surficial aquifer, the upper and lower Black Creek aquifers, the upper Cape Fear Formation, and the saprolite-bedrock, or basement, formation. Clay units at the top of the lower Black Creek aquifer, upper Cape Fear Formation, and saprolite-bedrock aquifer act as confining layers above these units. A discontinuous clay unit at the top of the upper Black Creek aquifer creates locally perched water table conditions in the overlying surficial aquifer: The surficial aquifer contains no confining units. The major water supply aquifer is the lower Black Creek aquifer (Refs. 5, p. 6; 9, p. 12; 12, p. 4; 24, pp. 1, 12-19).

3.0.3 Site Hydrogeologic Units

The Cape Fear Formation does not serve as an aquifer in the vicinity of the site, but rather serves as a confining layer over the saprolite-bedrock basement formations (Ref. 24, p. 18). Approximate thicknesses of the hydrogeologic units in the vicinity of the site are as follows:

Surficial Aquifer	25-40 Feet	(Ref. 11, pp. 15-16, 31)
Upper Black Creek Confining Layer	5-15 Feet	(Refs. 5, p. 6; 11, pp. 11, 17)
Upper Black Creek Aquifer	8-69 Feet	(Ref. 11, pp. 17, 31)
Lower Black Creek Confining Layer	10-15 Feet	(Ref. 11, pp. 17)
Lower Black Creek Aquifer	34-86 Feet	(Ref. 24, pp. 17, 31)
Cape Fear Confining Layer	<5 to >15 Feet	(Ref. 24, p. 18)

The depth to the top of the Lower Black Creek aquifer is between 48 and 139 feet below land surface (bls). MW-5A is screened at 60-70 feet bls, immediately above a confining unit approximately 10 feet thick (Ref. 12, pp. 8, 11). This unit closely coincides with the confining

unit between the Upper and Lower Black Creek aquifers. MW-5B is screened from 104-114 feet bls (Ref. 12, p. 8), in the Upper Black Creek hydrologic unit (Refs. 5, executive summary; 10, pp. 3, 7, 11, 15). MW-2B is screened from 106-116 feet bls (Ref. 10, p. 7), in the Upper Black Creek hydrologic unit (Ref. 5, executive summary). MW-1B is screened from 104-114 feet bls (Ref. 10, p. 3), in the Upper Black Creek hydrologic unit (Ref. 5, executive summary). Town of Aberdeen (TOA) Well #5 has a top of casing (toc) at 460 feet mean sea level (msl) and is screened from 390-384 msl, 376-354 msl, and 322-301 msl (Ref. 17, p. 14). This would calculate the screen depths to be 70-76 bls, 84-106 bls, and 138-159 bls. TOA Well #9 has a toc at 454 feet msl and is screened from 354-329 msl and 304-279 msl (Ref. 17, p. 14). This would calculate the screen depths to be 100-125 bls and 150-175 bls. TOA Well #18 is screened at 160-182 bls and 188-205 bls (Ref. 17, p. 24).

The three aquifers in the Site vicinity are interconnected. A study completed by the North Carolina Department of Natural Resources and Community Development (1980) considered deposits overlying the Cape Fear Formation as comprising a single aquifer system composed of hydrogeologic units of varying permeability and areal extent, all more or less hydraulically connected (Ref. 11, p. 5). The two confining layers separating the three aquifers have been documented to be absent in some locations in the immediate vicinity of the site, as discussed below:

The Surficial Aquifer consists of sands and sandy clay beds of the Pinehurst and Middendorf Formations. This aquifer is unconfined and consists mainly of lenses of perched ground water underlain by clay beds. The clay bed base overlies the Black Creek aquifer (Ref. 11, pp. 6, 11).

The clay unit separating the Surficial aquifer and the Upper Black Creek aquifer is absent or discontinuous between monitoring well MW-7D and temporary monitoring well TMW-3 (Ref. 11, pp. 11, 47, 50), therefore, the Surficial and the Upper Black Creek aquifers locally are vertically connected.

The Upper Black Creek and Lower Black Creek aquifer units are separated by a semi-continuous confining bed (Refs. 7, pp. 10, 28; 11, p. 6). The confining layer between the Upper Black Creek and Lower Black Creek aquifers is continuous between Geigy Chemical and Old Pee Dee Road (Ref. 7, pp. 9-10). However, stratigraphic data obtained at monitoring wells MW-22L and MW-29L, piezometer WP-5DB, and DPT (direct push technology) exploration P-33 indicate that the confining layer is not continuous in the area lying immediately west of Old Pee Dee Road (Ref. 7, p. 28). This absence of the confining layer extends south for an indeterminate distance, but is located within a maximum 700 feet (0.13 mile) from the source contaminant plume as delineated by MW5B, MW1B, TOA #5 and TOA #9. The approximate center of the plume is 1200 feet (0.23 mile) from the nearest documented area of aquifer connectivity (Fig. 2; Ref. 7, pp. 28, 70-72). The Upper and Lower Black Creek aquifers are in hydraulic communication where this discontinuity exists (Ref. 7, p. 10). Therefore, they are considered one aquifer throughout the rest of this HRS documentation record.

Regionally the Cape Fear Formation contains the upper Cape Fear aquifer, which consists predominantly of clay interbedded with silts and sand units (Ref. 24, p. 12). In the site vicinity, because of its predominantly clay lithology, the Cape Fear aquifer is relatively impermeable in nature and functions as a confining unit between the bottom of the Black Creek Aquifer (which contains interconnected upper and lower hydrologic units) and the top of the bedrock (Ref. 24, p. 18).

The surficial aquifer is widely used throughout the State for individual home wells. This aquifer is the

shallowest and most susceptible to contamination from septic tank systems and other pollution sources. Commonly, large diameter wells (up to 3 feet in diameter) are drilled up to 60 feet deep to store large quantities of water in the well casing. The surficial aquifer is also very sensitive to variations in rainfall amounts - they are the first to dry-up in a drought. Wells typically yield 25-200 gallons per minute (Ref. 12, p. 4).

The Black Creek Aquifer is recognized as a regional aquifer throughout the North Carolina Coastal Plain and is the primary source of water in the Aberdeen area. Aquifer tests conducted in the Aberdeen area indicate transmissivities ranging from 1,500 to 2,000 square feet per day. Wells typically yield 200-400 gallons per minute (Refs. 12, pp. 4-5; 24, pp 18-19).

It appears that ground water flows westward from the PMP property (subsequently known as Diamond Exhaust Products), discharging into Aberdeen Creek and its tributaries. The water table in the surficial aquifer has historically ranged from 42 to 500 [*sic*] feet below land surface (BLS) and 72 to 82 feet BLS in the Black Creek aquifer (Ref. 12, p. 5).

During the installation of two nested wells (EPA-1S, also known as MW-5A, and EPA-1D, also known as MW-5B) by US EPA SEDS in October 2003, stiff, gray indurated clay was encountered at 69 feet bls (Ref. 12, pp. 5, 11). This clay layer continued to 80 feet bls where sand was encountered until a similar gray clay was again detected at 114.5 feet bls (Ref. 12, pp. 11-12). The shallow well is screened immediately above the first gray clay and the intermediate well is screened immediately above the second clay layer (Ref. 12, pp. 5-6, 11-12). Relief over the area of the contaminated ground water plume is relatively flat and ranges from 400 feet above sea level along Old Pee Dee Road to 490 feet above sea level near Lockett Drive (Figure 1).

Aquifer/Stratum 1 (shallowest)

Aquifer/Stratum Name: Surficial Aquifer

Interconnected With: Upper portion of the Black Creek Aquifer

Type of Aquifer: Non-Karst

Description: The Surficial Aquifer occurs in sand and clayey sands of the Middendorf Formation and contains a perched saturated zone above the clay unit which forms its base. The clay unit, 5 to 15 feet thick, overlies the Black Creek aquifer and is encountered at most Lee Paving Company site wells at a depth of 60 to 70 feet. It is absent or discontinuous on the Lee Paving property between MW7D and TMW-3 (Ref. 11, pp. 11, 50).

Aquifer/Stratum 2

Aquifer/Stratum Name: Black Creek Aquifer

Interconnected With: Surficial Aquifer

Type of Aquifer: Non-Karst

Description: The Black Creek aquifer, comprised of sands and clayey sands of the Middendorf Formation, occurs at depth ranging from 70 to 80 feet at the Lee Paving Company site. The upper unit of the Black Creek aquifer is unconfined. Recharge to the aquifer occurs indirectly by leakage through the overlying clay bed and by direct infiltration in areas where the clay unit is not present (Ref. 11, p. 11).

3.1 LIKELIHOOD OF RELEASE

3.1.1 Observed Release

Aquifer being evaluated: 2

Chemical Analysis:

Background Concentrations

Well ID	Sampling Date	Sampling Time	Screened Interval	References
TOA #18	07/10/07	0845	160-182, 188-205 feet bgs	Ref. 17, pp. 6, 7, 24; Ref. 19, pp. 8-10; Ref. 20, p.1; Ref. 23, p. 1
MW2B	04/20/04	1400	106-116 feet	Ref. 10, pp. 7; Ref. 14, pp. 1, 3, 21; Ref. 16, p. 5

bgs = below ground surface

Hazardous Substances in background samples:

Well ID	TCE	1,1-DCE	cis-1,2-DCE	References
MDL/RRL	0.5 ug/l	0.5 ug/l	0.5 ug/l	Ref. 14, p. 21; 19, pp. 9-10
TOA #18	ND	ND	ND	Ref. 17, pp. 6, 7; Ref. 19, pp. 8-10; Ref. 20, p.1
MW2B	ND	ND	ND	Ref. 14, p. 1, 3, 21; Ref. 22, pp. 1 - 3

ug/l = micrograms per liter

MDL = method detection limit

RRL = required reporting limit

ND = Analyzed for but not detected

BOLD = Greater than or equal to 3 x background or greater than detection limit if background is non-detect

Chemical Analysis:

Contaminated Samples Ground Water

Well ID	Sampling Date	Sampling Time	Screened Interval	Refs.
MW5B	04/21/04	1820	104-114 feet bgs	Ref. 5, executive summary; Ref. 12, p. 8; Ref. 16, p. 27
MW1B	04/21/04	1415	104-114 feet bgs	Ref. 10, pp. 3, 4; Ref. 16, p. 19
TOA #5	07/10/07	0830	70-76, 84-106, 138-159 feet bgs	Ref. 17, pp. 2, 3, 14; Ref. 19, pp. 2-4
TOA #9	07/10/07	0930	100-125, 150-175 feet bgs	Ref. 17, pp. 4, 5, 14; Ref. 19, pp. 5-7

bgs = below ground surface

Contaminated Samples Ground water

Hazardous substances found in ground water release samples

Well ID	TCE	1,1-DCE	cis-1,2-DCE	Reference
MDL/RRL	0.5 ug/l	0.5 ug/l	0.5 ug/l	Ref. 14, p. 23; Ref. 19, pp. 3-4, 9-10
MW5B	1488.9 J (896.9)	15.8	3.6	Ref. 14, pp. 23; Ref. 22, pp. 1,2
MW1B	1181.1 J (711.5)	12.1	8.9	Ref. 14, pp. 23; Ref. 22, pp. 1,2
TOA #5	6.6	ND	ND	Ref. 17, pp. 2, 3; Ref. 19, pp. 2-4; Ref. 20, p. 1; Ref. 21, pp. 1 - 16
TOA #9	2.4	ND	ND	Ref. 17, p. 4, 5; Ref. 19, pp. 5-7; Ref. 20, p. 1; Ref. 21, pp. 1 - 16

ug/l = micrograms per liter

MDL = method detection limit

RRL = required reporting limit

ND = Analyzed for but not detected

BOLD = Greater than or equal to 3 x background or greater than detection limit if background is non-detect

J = Estimated Value (Ref. 14, p. 23), Bias uncertain (Ref. 22, p. 1), Value in parenthesis is result divided by Correction Factor of 1.66 to account for uncertain bias (Ref. 18, pp. 6, 7, 12)

3.1.2 Potential to Release

The criteria constituting an observed release by chemical analysis have been met; therefore, the potential to release has not been scored.

WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value	Tox./Mobility	Reference
TCE	1	10000	1	10000	Ref. 2, p. 2
1,1-DCE	1	100	1	100	Ref. 2, p. 3
cis-1,2-DCE	1	100	1	100	Ref. 2, p. 3

3.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous Constituent quantity data complete? (yes/no)
1	> 0	No

Hazardous Waste Quantity Factor Value = 100 based on Level I target concentrations (Ref. 1, Section 2.4.2.2). For a migration pathway, if the hazardous constituent quantity is not adequately determined for one or more sources, assign a factor value as follows: If any target for that migration pathway is subject to Level I or Level II concentrations, assign either the value from Table 2-6 or a value or **100**, whichever is greater, as the hazardous waste quantity factor value for that pathway (Ref. 1, section 2.4.2.2). Town of Aberdeen Well #5 has been impacted above the Maximum Contaminant Level (MCL) of 5 ug/l (Ref. 2, p. 2) and continues in use (Ref. 15), therefore, the population being served by this well is considered subject to Level I exposure (Ref. 1, Secs. 2.5.1, 2.5.2). Town of Aberdeen Well #9 has been impacted by TCE; the levels detected have not exceeded the MCL, however, the levels do exceed the Cancer Risk Screening Concentration (CRSC) of 0.21 ug/l (Ref. 2, p. 3) and continues in use (Ref. 15), therefore, the population being served by this well are considered subject to Level I exposure (Ref. 17, pp. 2, 3, 4, 5).

3.2.3 Waste Characteristics Factor Category Value

Hazardous Waste Quantity Factor Value: 100

Toxicity/Mobility Factor Value: 10,000

HWQFV x TMFV: $100 \times 10,000 = 1,000,000$

Waste Characteristics Factor Value: 32

3.3 Targets

Several private and industrial wells in the vicinity of the site have been removed from service, in part due to the levels of TCE in the water (Ref. 8). Currently, Town of Aberdeen Well #5 and Well #9, both of which are in use, have been impacted by TCE (Refs. 15; 19, pp. 2-7). Well #5 has been documented at levels above the MCL of 5 ug/l and is considered to be a Level I exposure (Refs. 2, p. 2; 19, pp. 2-4). Well #9 has been documented at levels above the Method Detection Limit (MDL) and above the CRSC but below the MCL and is therefore considered to be a Level I exposure (Refs. 2, p. 2; 19, pp. 5-7). Other wells are located within a 4 mile radius of the plume's center, however, they do not contribute significantly to the overall score of the site.

3.3.1 Nearest Well

Well: Town of Aberdeen Well #9

Level of Contamination: Level I

The closest Level I contaminated well for the site is the Town of Aberdeen Well #9 located on Blues Bridge Road approximately .25 miles east of the intersection of Blues Bridge Road and Old Pee Dee Road/Penwood Street (Fig. 2).

Nearest Well Factor Value: 50

3.3.2 Population

The Town of Aberdeen Municipal System is comprised of 17 wells (Ref. 15). These wells are split into 5 regions with each region having its own Water Tank. All of the tanks are interconnected to allow transfer of water between regions. Tanks 3, 4, and 5 transfer water among themselves on a routine basis. No one well contributes more than 40% of the total water supply (Ref. 23). The current population served by these 17 wells is 4655 people or 274 persons per well (Ref. 15; pp. 1, 2).

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

Level I Well	Population	Reference
TOA #5	274	Ref. 15, pp. 1, 2
TOA #9	274	Ref. 15, pp. 1, 2

$$274 + 274 = 548$$

$$548 * 10 = 5480 \text{ (Ref. 1, Sec. 3.3.2.2)}$$

Level I Concentration Factor Value: 5480

3.3.2.3 Level II Concentrations

Level II targets were not scored.

Level II Concentration Factor Value: 0

3.3.2.4 Potential Contamination

Not Scored– While several other wells that supply water to the Town of Aberdeen are located within a 4-mile radius of the plume’s center (Fig. 1), they have not been impacted and do not contribute significantly to the site score.

3.3.3 Resources

Not Scored

3.3.4 Wellhead Protection Area

Not Scored